PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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PCT

NOTIFICATION OF TRANSMITTAL OF
INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	18 NOV 2005
Applicant's or agent's file reference 27798	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IL04/00395	10 May 2004 (10.05.2004)	12 May 2003 (12.05.2003)

Applicant

CHEETAH MEDICAL INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/ US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Max Hindenburg Telephone No. (571) 272-3000

Form PCT/IPEA/416 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 27798	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/IL04/00395	International filing date *(day/month/year)* 10 May 2004 (10.05.2004)	Priority date *(day/month/year)* 12 May 2003 (12.05.2003)
International Patent Classification (IPC) or national classification and IPC IPC(7): A61B 5/02 and US Cl.: 600/504-507		
Applicant CHEETAH MEDICAL INC.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 10 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____ , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
22 June 2005 (22.06.2005)	11 October 2005 (11.10.2005)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Sharon N. Greene for Max Hindenburg Telephone No. (571) 272-3000

Form PCT/IPEA/409 (cover sheet)(April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IL04/00395

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☐ the international application in the language in which it was filed.

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))

☐ publication of the international application (under Rule 12.4(a))

☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:
pages 1-29 as originally filed/furnished
pages* NONE received by this Authority on _____
pages* NONE received by this Authority on _____

☒ the claims:
pages NONE as originally filed/furnished
pages* NONE as amended (together with any statement) under Article 19
pages* 30-39 received by this Authority on 22 June 2005 (22.06.2005)
pages* NONE received by this Authority on _____

☒ the drawings:
pages 1-16 as originally filed/furnished
pages* NONE received by this Authority on _____
pages* NONE received by this Authority on _____

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

☐ the description, pages _____
☒ the claims, Nos. 72-74
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

** If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IL04/00395

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-71	YES
	Claims NONE	NO
Inventive Step (IS)	Claims 1-71	YES
	Claims NONE	NO
Industrial Applicability (IA)	Claims 1-71	YES
	Claims NONE	NO

2. Citations and Explanations (Rule 70.7)

Claims 1-71 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a method or apparatus for measuring blood flow in an organ of a subject comprising wherein the output radiofrequency signals transmitted to the organ and input radiofrequency signals of the organ are mixed, so as to provide a mixed radiofrequency signal being indicative of the blood flow, and a portion of the mixed radiofrequency signal is filtered out so as to substantially increase a signal to noise ratio of a remaining portion of the mixed radiofrequency signal, in combination with all of the other limitations of the claims

Claims 1-71 meet the criteria set out in PCT Article 33(4), and thus meet industrial applicability because the subject matter claimed can be made or used in industry.

---------- NEW CITATIONS ----------

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claim 61 is objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: on line 1 of claim 61, "said plurality of is" should be replaced with "said plurality of electrodes is".

WHAT IS CLAIMED IS:

1. A system for measuring blood flow in an organ of a subject, the system comprising:

a radiofrequency generator for generating output radiofrequency signals;

a plurality of electrodes, designed to be connectable to the skin of the subject, said electrodes being for transmitting said output radiofrequency signals to the organ and for sensing input radiofrequency signals of the organ;

a mixer, electrically communicating with said radiofrequency generator and at least a portion of said plurality of electrodes, for mixing said output radiofrequency signals and said input radiofrequency signals, so as to provide a mixed radiofrequency signal being indicative of the blood flow; and

electronic circuitry, constructed and designed to filter out a portion of said mixed radiofrequency signal so as to substantially increase a signal-to-noise ratio of a remaining portion of said mixed radiofrequency signal.

2. The system of claim 1, wherein said mixer is operable to provide a radiofrequency sum and a radiofrequency difference.

3. The system of claim 2, wherein said electronic circuitry comprises a low pass filter for filtering out said radiofrequency sum.

4. The system of claim 1, wherein said electronic circuitry comprises an analog amplification circuit for amplifying said remaining portion of said mixed radiofrequency signal.

5. The system of claim 1, wherein said electronic circuitry comprises a digitizer for digitizing said remaining portion of said mixed radiofrequency signal.

6. The system of claim 1, wherein said electronic circuitry is designed and constructed so as to minimize sensitivity of said input radiofrequency signals to impedance differences between said plurality of electrodes and the organ of the subject.

7. The system of claim 6, wherein said electronic circuitry comprises at least one differential amplifier characterized by an impedance being substantially larger than said impedance differences between said plurality of electrodes and the organ of the subject.

8. The system of claim 1, further comprising a data processor for calculating at least one quantity using said remaining portion of said mixed radiofrequency signal, said at least one quantity being selected from the group consisting of a stroke volume, a cardiac output, a brain intra luminal blood flow and an artery blood flow rate.

9. The system of claim 8, wherein said artery blood flow rate is selected from the group consisting of an external carotid blood flow rate, an internal carotid blood flow rate, an ulnar blood flow rate, a radial blood flow rate, a brachial blood flow rate, a common iliac blood flow rate, an external iliac blood flow rate, a posterior tibial blood flow rate, an anterior tibial blood flow rate, a peroneal blood flow rate, a lateral plantar blood flow rate, a medial plantar blood flow rate, a deep plantar blood flow rate.

10. The system of claim 8, further comprising a pacemaker, communicating with said data processor and operable to control a heart rate of the subject, wherein said data processor is programmed to electronically control said pacemaker, in accordance with a value of said at least one quantity.

11. The system of claim 8, further comprising a drug administrating device, communicating with said data processor and operable to administrate drugs to the subject, wherein said data processor is programmed to electronically control said drug administrating device, in accordance with a value of said at least one quantity.

12. The system of claim 8, further comprising a cardiac assist device, communicating with said data processor and operable to increase said cardiac output.

13. The system of claim 12, wherein said cardiac assist device comprises a reinforcing member designed and configured to restrict an expansion of a portion of a heart tissue, thereby to increase said cardiac output.

14. The system of claim 1, wherein a number of said plurality of electrodes is selected so as to substantially decouple said input radiofrequency signals from at least one effect selected from the group consisting of a posture changes effect, a respiration effect and a motion effect.

15. The system of claim 1, wherein said plurality of electrodes comprises two electrodes.

16. The system of claim 1, wherein said plurality of electrodes comprises three electrodes.

17. The system of claim 1, wherein said plurality of electrodes comprises four electrodes.

18. The system of claim 1, wherein at least a portion of said plurality of electrodes are designed and constructed to so as to have a substantial constant sensitivity to electrical signals transmitted through said electrodes, irrespectively of an orientation of said electrodes on the subject.

19. The system of claim 1, wherein at least a portion of said plurality of electrodes comprises at least one elongated conducting material constructed and designed to wind at least a portion of an external organ of the subject, so as to have a substantial constant sensitivity to electrical signals transmitted through said electrodes, irrespectively of an orientation of said electrodes on said external organ.

20. The system of claim 19, wherein at least a portion of said plurality of electrodes comprises an attaching material.

21. The system of claim 19, wherein said external organ is selected from the group consisting of a chest, a hip, a thigh, a neck, a head, an arm, a forearm, an abdomen, a gluteus, a leg and a foot.

22. The system of claim 1, further comprising a bioimpedance detector electrically communicating with at least a portion of said plurality of electrodes for detecting a voltage between a first location and a second location of the subject and for generating said input radiofrequency signals in response to said voltage, wherein said input radiofrequency signals being indicative of impedance of the organ.

23. The system of claim 22, further comprising at least one sensor for sensing said voltage, said at least one sensor being constructed and designed for generating signals having a magnitude which is a function of blood flow in, from or to the organ.

24. The system of claim 22, wherein said electronic circuitry comprises a differentiator for performing at least one time-differentiation, to provide a respective derivative of said impedance between said first and said second locations.

25. The system of claim 24, wherein said derivative is selected from the group consisting of a first derivative and a second derivative.

26. The system of claim 24, wherein said differentiator is selected from the group consisting of a digital differentiator and an analog differentiator.

27. The system of claim 1, further comprising a display device for displaying the blood flow.

28. The system of claim 27, wherein said display device is capable of displaying the blood flow as a function of time.

29. The system of claim 1, wherein said signal-to-noise ratio is increased by at least 10dB.

30. The system of claim 1, wherein said signal-to-noise ratio is increased by at least 20dB.

31. An apparatus for determining blood flow in an organ of a subject, the apparatus having a radiofrequency measuring unit, the radiofrequency measuring unit is capable of transmitting output radiofrequency signals to the organ and receiving input radiofrequency signals of the organ, the apparatus comprising:

(a) a mixer, electrically communicating with said radiofrequency measuring unit, for mixing said output radiofrequency signals and said input radiofrequency signals, so as to provide a mixed radiofrequency signal being indicative of the blood flow; and

(b) electronic circuitry, constructed and designed to filter out a portion of said mixed radiofrequency signal so as to substantially increase a signal-to-noise ratio of a remaining portion of said mixed radiofrequency signal.

32. The apparatus of claim 31, wherein said mixer is operable to provide a radiofrequency sum and a radiofrequency difference.

33. The apparatus of claim 32, wherein said electronic circuitry comprises a low pass filter for filtering out said radiofrequency sum.

34. The apparatus of claim 31, wherein said electronic circuitry comprises an analog amplification circuit for amplifying said remaining portion of said mixed radiofrequency signal.

35. The apparatus of claim 31, wherein said electronic circuitry comprises a digitizer for digitizing said remaining portion of said mixed radiofrequency signal.

36. The apparatus of claim 31, wherein said electronic circuitry is designed and constructed so as to minimize sensitivity of said input radiofrequency signals to impedance differences between said plurality of electrodes and the organ of the subject.

37. The apparatus of claim 36, wherein said electronic circuitry comprises at least one differential amplifier characterized by an impedance being substantially larger than said impedance differences between said plurality of electrodes and the organ of the subject.

38. The apparatus of claim 31, wherein said electronic circuitry comprises a differentiator for performing at least one time-differentiation, to provide a respective derivative of an impedance between a first location and a second location of the body of the subject.

39. The apparatus of claim 38, wherein said derivative is selected from the group consisting of a first derivative and a second derivative.

40. The apparatus of claim 38, wherein said differentiator is selected from the group consisting of a digital differentiator and an analog differentiator.

41. The apparatus of claim 31, wherein said signal-to-noise ratio is increased by at least 10dB.

42. The apparatus of claim 31, wherein said signal-to-noise ratio is increased by at least 20dB.

43. A method of measuring blood flow in an organ of a subject, the method comprising:

generating output radiofrequency signals;

transmitting said output radiofrequency signals to the organ and sensing input radiofrequency signals of the organ;

mixing said output radiofrequency signals and said input radiofrequency signals, so as to provide a mixed radiofrequency signal being indicative of the blood flow; and

filtering out a portion of said mixed radiofrequency signal so as to substantially increase a signal-to-noise ratio of a remaining portion of said mixed radiofrequency signal, thereby measuring the blood flow.

44. The method of claim 43, wherein said mixing comprises providing a radiofrequency sum and a radiofrequency difference.

45. The method of claim 44, wherein said filtering said portion of said mixed radiofrequency signal is by a low pass filter constructed and designed for filtering out said radiofrequency sum.

46. The method of claim 43, further comprising analogically amplifying said remaining portion of said mixed radiofrequency signal.

47. The method of claim 43, further comprising digitizing said remaining portion of said mixed radiofrequency signal.

48. The method of claim 43, wherein said electronic circuitry is designed and constructed so as to minimize sensitivity of said input radiofrequency signals to impedance differences between said plurality of electrodes and the organ of the subject.

49. The method of claim 48, wherein said electronic circuitry comprises at least one differential amplifier characterized by an impedance being substantially larger than said impedance differences between said plurality of electrodes and the organ of the subject.

50. The method of claim 43, further comprising calculating at least one quantity using said remaining portion of said mixed radiofrequency signal, said at least one quantity being selected from the group consisting of a stroke volume, a cardiac output and a brain intra luminal blood volume and an artery blood flow rate.

51. The method of claim 50, wherein said artery blood flow rate is selected from the group consisting of an external carotid blood flow rate, an internal carotid blood flow rate, an ulnar blood flow rate, a radial blood flow rate, a brachial blood flow rate, a common iliac blood flow rate, an external iliac blood flow rate, a posterior tibial blood flow rate, an anterior tibial blood flow rate, a peroneal blood flow rate, a

lateral plantar blood flow rate, a medial plantar blood flow rate, a deep plantar blood flow rate.

52. The method of claim 50, further comprising controlling a heart rate of the subject in accordance with a value of said at least one quantity.

53. The method of claim 52, wherein said controlling a heart rate of the subject is by a pacemaker.

54. The method of claim 50, further comprising using a value of said at least one quantity for selecting an amount and a type of drugs and administrating said amount and said type of drugs to the subject.

55. The method of claim 50, further comprising providing a site of surgical access to a portion of a heart of a subject and maintaining the reduction of cardiac expansion of said portion of said heart a substantial amount of time so as to increasing said cardiac output.

56. The method of claim 43, wherein said transmitting said output radiofrequency signals to the organ and sensing said input radiofrequency signals of the organ is by connecting a plurality of electrodes to the skin of the subject.

57. The method of claim 56, wherein a number of said plurality of electrodes is selected so as to substantially decouple said input radiofrequency signals from at least one effect selected from the group consisting of a posture changes effect, a respiration effect and a motion effect.

58. The method of claim 56, wherein said plurality of electrodes comprises two electrodes.

59. The method of claim 56, wherein said plurality of electrodes comprises three electrodes.

60. The method of claim 56, wherein said plurality of electrodes comprises four electrodes.

61. The method of claim 56, wherein said connecting said plurality of is done so as to have a substantial constant sensitivity to electrical signals transmitted through said electrodes, irrespectively of an orientation of said electrodes on the subject.

62. The method of claim 56, wherein at least a portion of said plurality of electrodes comprises at least one elongated conducting material constructed and designed to wind at least a portion of an external organ of the subject, so as to have a substantial constant sensitivity to electrical signals transmitted through said electrodes, irrespectively of an orientation of said electrodes on said external organ.

63. The method of claim 62, wherein said external organ is selected from the group consisting of a chest, a hip, a thigh, a neck, a head, an arm, a forearm, an abdomen, a gluteus, a leg and a foot.

64. The method of claim 43, further comprising detecting a voltage between a first location and a second location of the subject and generating said input radiofrequency signals in response to said voltage, wherein said input radiofrequency signals being indicative of impedance of the organ.

65. The method of claim 64, further comprising performing at least one time-differentiation thereby providing a respective derivative of said impedance between said first and said second locations.

66. The method of claim 65, wherein said derivative is selected from the group consisting of a first derivative and a second derivative.

67. The method of claim 65, wherein said performing said time-differentiation is effected by a procedure selected from the group consisting of a digital differentiation and an analog differentiation.

68. The method of claim 43, further comprising displaying the blood flow using a display device.

69. The method of claim 68, wherein said display device is capable of displaying the blood flow as a function of time.

70. The method of claim 43, wherein said signal-to-noise ratio is increased by at least 10dB.

71. The method of claim 43, wherein said signal-to-noise ratio is increased by at least 20dB.